Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E

Introduction

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E dataset consists of browse only images showing radar reflectivity, radar echo top, convective available potential energy (CAPE), temperature, geopotential height, wind speed, relative humidity, rain water, snow, cloud water, cloud ice, and graupel. These data were simulated by the Weather Research and Forecasting (WRF) for the period of the GPM Ground Validation Mid--latitude Continental Convective Cloud Experiment (MC3E) field campaign. The overarching goal of the MC3E field campaign was to provide the most complete characterization of convective cloud systems, precipitation, and the environment ever obtained and to provide new constraints for model cumulus parameterizations and space--based rainfall retrieval algorithms over land. Browse imagery files in PNG and GIF formats are available for April 19, 2011 through June 6, 2011.

Citation

Peters-Lidard, Christa. 2018. GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/MC3E/WRF/DATA101

Keywords:

NASA, GPM GV, MC3E, WRF, radar reflectivity, radar echo top, temperature, CAPE, geopotential height, dew point temperature, relative humidity, wind speed, rain water, snow, cloud water, cloud ice, graupel

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation (GV) campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The

instrument validation effort included numerous GPM-specific and joint-agency/ international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). Surface rainfall was measured by very dense rain gauge and disdrometer networks at various field campaign sites. These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is available at http://pmm.nasa.gov/GPM.

The Midlatitude Continental Convective Clouds Experiment (MC3E) was a GPM GV field campaign which took place in central Oklahoma during April--June 2011. MC3E used a multi-scale observing strategy with the participation of a network of distributed sensors (both passive and active). The objective was to document and monitor in 3D not only precipitation, but also clouds, winds, and moisture in an attempt to provide a holistic view of convective clouds, their environment, and any associated feedbacks. The experiment was a collaborative effort between the U.S. Department of Energy (DOE), Atmospheric Radiation Measurement (ARM), Climate Research Facility, and the National Aeronautics and Space Administration's (NASA) GPM GV program and consisted of measurements from the observing infrastructure currently available in the central United States, an extensive set of sounding array, remote sensing, and in situ aircraft observations, data from the NASA GPM GV remote sensors, and a new ARM instrumentation purchased with American Recovery and Reinvestment Act funding. The measurements have provided newly available constraints for model cumulus parameterizations and space--based rainfall retrieval algorithms over land. Further details on GPM MC3E are available at https://ghrc.nsstc.nasa.gov/home/field-campaigns/mc3e and https://www.nasa.gov/topics/earth/features/rain-campaign.html.

Product Description

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E data were simulated by the Weather Research and Forecasting (WRF) model (Skamarock and Klemp, 2008). WRF is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications. It features two dynamical cores, a data assimilation system, and a software architecture supporting parallel computation and system extensibility. The model serves a wide range of meteorological applications across scales from tens of meters to thousands of kilometers.

This dataset contains browse imagery of radar reflectivity, radar echo top, convective available potential energy (CAPE), temperature, geopotential height, wind speed, relative humidity, rain water, snow, cloud water, cloud ice, and graupel from the WRF model. CAPE is the amount of energy a parcel of air would have if lifted a certain distance vertically through the atmosphere. CAPE is effectively the positive buoyancy of an air parcel and is an indicator of atmospheric instability, which makes it very valuable in predicting severe weather. An echo top is the radar indicated top of an area of precipitation. Echo tops can be

used to assess the intensity of a storm. More information about the WRF model can be found at https://www.mmm.ucar.edu/weather-research-and-forecasting-model.

Investigators

Christa Peters-Lidard
NASA/GSFC
Greenbelt, MD

Data Characteristics

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E data files are browse only images showing WRF-simulated radar reflectivity, radar echo top, CAPE, temperature, geopotential height, wind speed, relative humidity, rain water, snow, cloud water, cloud ice, and graupel estimates for the Mid--latitude Continental Convective Cloud Experiment (MC3E) field campaign. These data are Level 4 processing level, and more information about the NASA data processing levels are available on the EOSDIS Data Processing Levels webpage. Table 1 shows the characteristics of each browse file.

Table 1: Data Characteristics

Characteristic	Description
Platform	Computer
Instrument	Weather Research and Forecasting (WRF) model
Spatial Coverage	N: 45.0, S: 25.0, E: -80.0, W: -115.0 (Oklahoma)
Temporal Coverage	April 19, 2011 - June 6, 2011
Temporal Resolution	hourly
Sampling Frequency	hourly
Parameter	Radar reflectivity, radar echo top, CAPE, surface dew point temperature, surface temperature, geopotential height, relative humidity, wind speed, rain water, snow, cloud water, cloud ice, graupel
Version	1
Processing Level	4

File Naming Convention

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E dataset has the following file naming convention:

Browse files: mc3e_wrf_[basic|dbz|hydro]_<initiation time>_<output time>.png
mc3e_wrf_[basic|dbz|hydro]_<initiation time>_animation.gif

Table 2: File naming convention variables

Variable	Description
basic	Images showing radar reflectivity, CAPE, surface dew point temperature, surface temperature, geopotential height, relative humidity, and wind speed
dbz	Images showing radar reflectivity and radar echo top
hydro	Images showing rain water, snow, cloud water, cloud ice, and graupel
<initiation time>	WRF model initiation time formatted as YYYYMMDDhh. YYYY: four-digit year MM: two-digit month DD: two-digit day hh: two-digit hour in UTC
<output time>	WRF model output time formatted as YYYYMMDD_hhmm. YYYY: four-digit year MM: two-digit month DD: two-digit day hh: two-digit hour in UTC mm: two-digit minute in UTC
.png	Portable Network Graphics format
.gif	Graphic Interchange Format

Data Format and Parameters

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E dataset's browse imagery files are in PNG and GIF formats. Parameters include radar reflectivity, radar echo top, CAPE, surface dew point temperature, surface temperature, geopotential height, relative humidity, wind speed, rain water, snow, cloud water, cloud ice, and graupel.

Software

The GPM Ground Validation Weather Research and Forecasting (WRF) Images MC3E dataset contains browse only imagery in PNG and GIF formats. No software is required to view these imagery files.

Known Issues or Missing Data

There are no known issues with these data or any known gaps in the dataset.

References

Skamarock, W. C. and J. B. Klemp (2008). A time split non hydrostatic atmospheric model

for weather research and forecasting applications, *J. Comp. Physics.*, 227, 7, 3465-3485. doi: 10.1016/j.jcp.2007.01.037

Related Data

All other data collected during the MC3E field campaign are considered related datasets. Other MC3E data can be located using the GHRC HyDRO 2.0 search tool with the search term 'MC3E'.

Contact Information

To order these data or for further information, please contact:

NASA Global Hydrology Resource Center DAAC
User Services
320 Sparkman Drive
Huntsville, AL 35805
Phone: 256-961-7932
E-mail: support-ghrc@earthdata.nasa.gov
Web: https://ghrc.nsstc.nasa.gov/

Created: November 5, 2018